to Zumbo, and thence for a distance of 300 miles up the Loangwe river.

A NOMINATION to the geographical studentship of £100 in the University of Oxford will be made at the end of Hilary term, 1893. Particulars of the appointment may be obtained from Mr. Mackinder, the Reader in Geography.

TWO sudden deaths of men known in connection with minor exploration and geographical writing are announced. Mr. Theodore Child, author of "South American Republics" and other works, died of cholera at Ispahan, and Lieutenant Frederick Schwatka, who has travelled extensively in Alaska, committed suicide in Portland, Oregon.

MR. PRATT, whose departure for the head-waters of the Amazon was announced in this column at the time, has been compelled to relinquish the expedition on account of ill-health, and is now in this country.

AT the first meeting of the Royal Geographical Society the certificates of 106 new members, including 15 ladies, were read. This is the largest number seeking admission into the society which has yet been proposed at one time.

DR. NANSEN'S ARCTIC EXPEDITION.

DR. FRIDTJOF NANSEN opened the session of the Royal Geographical Society on Monday night by a description of his plans for crossing the north polar region, and received a most enthusiastic reception from a crowded audience. His scheme involves two separate considerations: (1) the direction of the prevailing polar currents, and (2) the means by which these currents can be utilized for transporting an expedition. All attempts to reach the pole by Smith Sound, by the east coast of Greenland, and by the north of Spitzbergen have been complicated by contrary currents; the few expeditions by way of Bering Sea, although equally unsuccessful, have had the currents in their favour.

Taking into account all the available data, it appears that the polar current between Greenland and Spitzbergen carries southward between 80 and 120 cubic miles of water every twenty-four hours. The Gulf Stream drift may carry 60 or 70 cubic miles of water a day into the polar basin north of Nova Zembla, about 10 or 14 cubic miles daily probably flow in through Bering Strait, and possibly about one cubic mile a day of fresh water pours in on the average from the great Siberian rivers. This comparatively small addition of fresh water must account for the salinity of the Greenland outflowing current being somewhat less than the average salinity of the North Atlantic. Theoretically there would thus appear to be a current running from near the New Siberian Islands towards the north of Greenland.

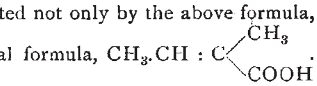
The existence of such a current is strongly indicated by the drift of the *Jeannette* from 71° 30′ to 77° 15′ N. after being caught in the ice, this drift being northwestward from Bering Strait. Again, articles lost on the sinking of the *Jeannette* in the latter position off the New Siberian Islands were found on an ice-floe near Julianehaab, in the south of Greenland. A throwing-stick, of a kind made only by the Eskimo of Alaska, was found a few years ago near Godthaab, on the west of Greenland. Siberian driftwood is stranded regularly on the coasts of Greenland, and even on the north coast of Spitzbergen. These facts can only be accounted for by the theory of an ocean current across the polar basin. The evidence of the relative thickness of ice in different parts of the Arctic Sea, and of the occurrence of Siberian diatoms in the mud of ice-floes between Greenland and Iceland is strongly confirmatory.

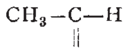
Dr. Nansen intends to make the northwesterly current transport him across the middle of the polar basin, and so give him an opportunity for making scientific observations nearer the pole than has ever previously been done. He will sail next June *via* the Kara Sea for the New Siberian Islands, thence work a way as far north as possible; when stopped, he will run into the ice, and await the time when he will be drifted into the open sea again between Greenland and Spitzbergen. He has had a ship built in Norway expressly for the voyage. Her form is such as to cause the ice, on closing round, to lift her out of the water, and she will rest upright on its surface. This vessel, named the *Fram* (*i.e.* Forward), is built of very long-seasoned timber, and is more strongly put together than any other vessel of her size. The frame timbers are of great thickness, and set close together, so that if all the planking were stripped off the vessel would remain water-tight. The planking is first a ceiling of pitch pine, alternately 4 and 8 inches thick, then outside two layers of oak, 3 and 4 inches thick respectively, and over all is an "ice-sheathing" of from 3 to 6 inches of the hard and slippery greenheart. The sides are thus from 28 to 32 inches thick of solid wood. The decks are equally strong, and the cabins are planned so as to be isolated by store rooms and coal-bunkers from the sides, while non-conducting materials such as cork, felt, and reindeer hair are introduced between the walls or decks and the rooms to guard the crew from cold.

The vessel is sharp fore and aft, and both propeller and rudder may be lifted in wells so as to avoid risk of fouling the ice. The rudder is deeply immersed when in action, so that floating ice will not touch it. Both stem and stern overhang greatly, and are heavily plated with iron to crush and cut through thin ice. The length of keel is 101 feet, and the length of deck over all is 128, while the greatest beam (exclusive of ice sheathing) is 36 feet, and the depth 17 feet. These proportions are very unusual, but were adopted as the result of experience in other ships. With light cargo she will draw 12 feet, and fully loaded 15½, the displacement being about 800 tons. She is rigged as a three-masted schooner, with square sails on the foremast, and has an engine of 160 indicated horse-power. The crow's nest on the maintopmast is 105 feet above the water-line, so as to give a wide horizon for the look-out. Two large decked boats are carried, in either of which the whole crew of twelve men could live if the ship were lost. Dogs, sledges, ski, several small boats, canvas for building extra boats on an emergency, and provisions for five or six years are taken. A pendulum apparatus is included in the scientific outfit, which is otherwise very complete. The ship is fitted with electric light; the dynamo may be worked by a windmill when coal can no longer be spared, or as a last resort it can be driven by a capstan arrangement adapted for four men, thus supplying healthy exercise and useful work to one-third of the crew, and abundant light to the remaining two-thirds.

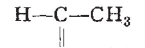
The duration of the voyage cannot be estimated, as it will entirely depend on the rate of drifting, which must vary considerably from year to year, but judging from the movement of the *Jeannette* relics, two years ought to suffice.

A REMARKABLE CASE OF GEOMETRICAL ISOMERISM.

AN exceptionally interesting memoir is contributed to the current number of *Liebig's Annalen* by Prof. Wislicenus of Leipzig, who has latterly identified himself so earnestly with the subject of molecular configuration. It has been suspected for some years that there are two isomeric unsaturated acids of the composition $C_4H_7.COOH$. One of these substances exists in the free state in the roots of *Angelica archangelica* and has therefore received the name of *angelic acid.* The other compound is found along with angelic acid in Roman oil of cumin and has been termed *tiglic acid.* These two acids, moreover, behave so similarly in almost all their reactions with other substances that the conclusion has been rendered inevitable that they must be represented not only by the above formula, but by the same constitutional formula,  $CH_3.CH : C\!\begin{matrix} \diagup CH_3 \\ \diagdown COOH \end{matrix}$. That the two acids are not identical, however, was indicated by certain slight differences of behaviour, and Prof. Wislicenus felt convinced that the two were in fact geometrical- or stereo-isomers, the difference consisting in a different arrangement of their various radicle groups in space. He considers it probable that the nature of the difference may be represented in one plane by the following formulæ:


$$\begin{matrix} CH_3-C-H \\ \Vert \\ CH_3-C-COOH \end{matrix}$$

and


$$\begin{matrix} H-C-CH_3 \\ \Vert \\ CH_3-C-COOH. \end{matrix}$$

Angelic acid. Tiglic acid.

Judging from previous experience of the behaviour of other geometrical isomers of a similar nature, it appeared probable that the halogen addition products of the two acids would exhibit differences so marked as to determine definitively the separate nature of the two acids. Under the direction of Prof. Wislicenus, therefore, one of his pupils, Herr Pückert, undertook the investi-

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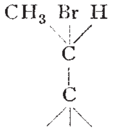
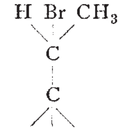
gation of the bromine addition products of angelic and tiglic acids, and was successful in showing that the two products were essentially different, exhibiting properties indeed so dissimilar that their identity was entirely out of the question. Although their similar constitution was indicated by melting-points differing by only one or two degrees, yet it was found that the crystals of the dibromide of angelic acid immediately reacted with water with production of a colourless oil, whilst the dibromide of tiglic acid remained unchanged in contact with water; moreover, the two compounds upon decomposition of their sodium salts, yielded two mono-brom-pseudo-butylenes, which differed essentially in their capability of reacting with alcoholic potash.

In the year 1890, however, Prof. Fittig, of Strassburg, who had previously investigated the subject in conjunction with Herr Pagenstecher, and had obtained *identical* bromine addition products from the two acids, published a paper in the *Annalen* in which he sought to show that the results of Herr Pückert were incorrect, and that the two substances were identical. Prof. Fittig has since requested Prof. Wislicenus to withdraw the work or substantiate it, and further charges Prof. Wislicenus with seeing facts through the veil of his theory. Unfortunately Prof. Wislicenus has been unable hitherto to meet the attack owing to domestic loss and serious illness, but at last he is able to publish the results of a really classical piece of work which he has carried through himself, and which not only demonstrates the truth of Herr Pückert's conclusions, but places the results beyond all criticism, and shows the singular cause of Prof. Fittig's inability to repeat them. It is indeed remarkable, but nevertheless true, that the fate of the theory of geometrical isomerism has actually been trembling in the balance owing to the different situation of the draught cupboards in the Leipzig and Strassburg laboratories. In the former laboratory they are placed *between* the windows, and in deep shadow; in the Strassburg laboratory they are *against* the windows, and are consequently brightly illuminated in daylight. Now Prof. Wislicenus shows that the dibromide of angelic acid is only formed in the absence of bright light, *rays of daylight intensity being absolutely fatal to its formation.* Hence Prof. Fittig only obtained the relatively more stable dibromide of tiglic acid, which in a good light is yielded by both angelic and tiglic acids. As the case is so remarkable, it may perhaps not be uninteresting to give a brief summary of the work of Prof. Wislicenus.

During the course of other researches concerning geometrical isomers, it was found that in order to obtain addition-products in which no internal re-arrangement of atoms had occurred, it was necessary to observe three conditions. One must operate at the lowest possible temperature, exclude light as much as possible, and take care that the halogen to be added is always present in tolerably large excess. When these three conditions are observed, the two respective and distinct bromine addition-products of angelic and tiglic acids are always obtained. They are probably represented by the formulæ—



Dibromide of angelic acid.



Dibromide of tiglic acid.

The operation of preparation is best conducted as follows:—A quantity of bromine, at least half as much again as is required by theory, and dissolved in three times its weight of carbon bisulphide, is placed in a flask surrounded by iced water. The flask is fitted with a triply bored caoutchouc stopper, through one hole of which is inserted a thermometer, through a second an exit tube furnished with a calcium chloride drying tube, and through the third the end of a burette containing a solution of pure angelic or tiglic acid in five times its weight of carbon bisulphide. The draught cupboard is darkened as much as possible and then the acid solution is slowly allowed to run into the flask. After the expiration of a few hours the formation of the brominated compound is complete, and the carbon bisulphide may be evaporated away in a rapid stream of dry air.

The difference between the two compounds is apparent even at this early stage, for the tiglic compound commences to crystallize long before the removal of all the carbon bisulphide, and soon forms a snow-white mass of crystals. On the contrary, the angelic dibromide shows no sign of crystallization, remaining as an oil for some time after the removal of all the carbon bisulphide. Eventually it crystallizes to a hard yellowish mass. The only solvent from which it was found practicable to recrystallize the angelic dibromide was the pentane fraction of petroleum ether boiling at 33°–39°.

The melting-point of pure angelic dibromide is 86·5–87. That of tiglic dibromide is 87·5–88. The two substances behave quite differently upon resolidification. The former congeals to a transparent resinous mass, whilst the latter forms an opaque solid.

The most striking difference is apparent in their respective behaviour towards water. The dibromide of tiglic acid is only slightly soluble in water, and dissolves unchanged, crystallizing out again upon evaporation. The dibromide of angelic acid, however, instantly combines with the equivalent of one molecule of water, to form a curious unstable liquid, an oil of high refractive power, which is somewhat soluble in excess of water, and is again deposited upon evaporation. This liquid compound is also formed when the dibromide is exposed to moist air, while the dibromide of tiglic acid is not changed in a moist atmosphere. In dry air the angelic liquid compound again dissociates into the dibromide and water vapour. In fact the dibromide of angelic acid would appear to act as an excellent indicator of the hygroscopic state of the atmosphere.

The two dibromides show a further difference in solubility, the angelic compound being far more readily soluble in all the solvents experimented with.

Finally the crystals of the two compounds, although both belonging to the triclinic system, are absolutely unlike. From measurements made by Dr. Fock, they are shown to exhibit different forms, entirely different angles, and different disposition of optic axes.

From the above description it will be quite evident that the two compounds are certainly not identical.

In conclusion, Prof. Wislicenus gives the results of attempts to obtain the dibromide of angelic acid in bright sunshine in the open air, then when working in front of a window, and again when the experiment was performed upon a table in the centre of the laboratory. In the first case, instead of the angelic compound, 92·8 per cent. of the dibromide of tiglic acid was obtained, in the second case 89·6, and in the third case 88·7 per cent. These results render it perfectly clear why Prof. Fittig could not obtain the angelic compound in his experiments, and they also show how it is possible for two chemists, both working with a desire to ascertain the truth, occasionally to obtain results apparently at complete variance with each other.

A. E. TUTTON.

MARINE LABORATORIES IN THE UNITED STATES.[1]

ONLY in comparatively recent times has the tremendous importance of the bearing of the invertebrates upon the general questions of biology been appreciated. We have seen that some work was done upon these animals at an early date, when the minds of workers were not much troubled by theoretical considerations, but the study of the adult forms is so small a part of a real understanding of these animals that it was unsatisfactory work, and never became popular among investigators until embryological methods had been introduced.

Dr. Brooks has remarked that "nearly every one of the great generalizations of morphology is based upon the study of marine animals, and most of the problems which are now awaiting a solution must be answered in the same way."[2] We find the reason for this in the fact that the biology of the present day is a study of vital phenomena and of natural laws governing living things. The importance of the invertebrates depends, therefore, upon the fact that in them life exists under simplified conditions, affording opportunities for the study of questions for which higher forms are, with our present knowledge, too complex.

As the study of invertebrates has extended, it has become more and more desirable to have more favourable conditions for this work, more abundant facilities for collecting and oppor-

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[1] Reprinted from "Biological Teaching in the Colleges of the United States," by John P. Campbell, Professor of Biology in the University of Georgia; issued by the U.S. Bureau of Education.

[2] Johns Hopkins University Circulars, vol. vi., p. 37.

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